High Performance School Design

Principles and Practical Application

The Prisco Group, PC · A Professional Corporation ·



Principles of High Performance Design

- 1. Holistic Design Approach
- 2. Sustainable Site Design
- 3. Water Efficiency
- 4. Energy & Atmosphere Conservation
- 5. Materials & Resource Conservation
- 6. Indoor Air Quality
- 7. Education/Community
- 8. Commissioning



• • • Holistic Design

- Ensures all building components function most efficiently by working as a system;
- All stake holders are involved in the design process to reach a consensus design that is healthy, profitable, and resource efficient.

• • • Sustainable Site Design

- Protects natural amenities,
- Restores the ecosystem whenever possible,
- Orients the building to take advantage of natural site features

• • Water Efficiency

- Reduces the drain on our water supply by using high efficiency or no-flush fixtures
- Captures & uses natural resources such a rain water for irrigation and flushing instead of drinking water.
- Eliminates or reduces contaminant run-off from the site through proper treatment such as constructed wetlands or filtering.

Energy & Atmosphere Conservation

- Reduces reliance on fossil fuels
 - Renewable energy systems such as Solar, Wind,
 & Biomass with Utility rebates of 50-60% of first cost.
- Eliminates HCFC's & CFC from Heating & Air Conditioning Systems & building products
 - Such as insulation
- Reduces energy consumption & operating costs by using efficient lighting, HVAC design, and sensors in combination with natural lighting & ventilation.
 - Up to 50-90% reduced energy use can be obtained on time & within your budget.
 - Utility rebates also exist.

Material & Resource Performance

- Specify materials that are non-toxic.
- Use materials made with significant recycled content.
- Require that materials be easily recycled at the end of their useful life.
- Specify materials that perform well acoustically, are highly durable, and not maintenance intensive

• • Indoor Air Quality

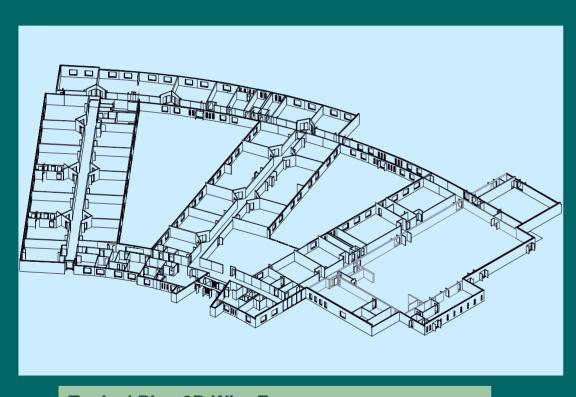
- People spend 90% of time in buildings. Providing a healthy workplace improves occupant satisfaction and increased performance of students & staff by 25%.
- Eliminate formaldehyde, VOC's, and Chlorine found in many typical building products which off gas toxins and are dangerous in fires.
- Provide adequate HVAC with 100% outside air & proper filtration
- Providing abundant lighting and controls through indirect and natural means
- Providing sufficient opportunity for users to regulate the temperature with localized controls integrated with sensors.

Education / Community Involvement

- The building is a teaching tool for math and science principles.
- Buildings which are accessible to the community, representative of the community in form and flexibility, and which instill a sense of pride are buildings which will be well-maintained, well-received, and well-utilized for generations.
- Design to protect our environment for our grandchildren's grandchildren not just for today.

Practical Applications:

Howell Elementary Schools



Typical Plan 3D Wire Frame

- Two new K-5, 70,000 sf elementary schools for 500 students
- o Occupied:
 - Sept. 2003
- o Budget
 - \$138/s.f.
- o Actual Cost
 - \$131/s.f.
- Designed to LEED
 Silver Certification.

CASE STUDY: Howell Elementary Schools



Front Elevation Rendering

- o Established goals
 - Holistic Design Approach
 - Sustainable Site Design
 - Water Efficiency
 - Energy & Atmosphere Conservation
 - Material & Resource Conservation
 - Indoor Air Quality
 - Community
 - Commissioning

Practical Applications:

Howell Elementary Schools



Typical Plan

o Holistic Design Approach:

 Architect, Owner, Construction Manager, and Users involved after referendum to establish sustainable design goals using LEED.

o Sustainable Sites:

- Energy Star Roof
- Downlighting exterior
- Dealdrin Cleanup

o Water Conservation:

No irrigation system for fields.

Practical Applications:

Howell Elementary Schools



Entry Close-up Perspective

- o Energy & Atmosphere Conservation:
 - Fundamental Systems Commissioning*
 - CFC & HCFC Free HVAC Equipment
 - Optimized energy performance by 60% above code
 - 50kW Photovoltaic
 System for min. 5%
 power generation w/ 9
 year first cost payback &
 300% lifecycle payback.

Microsoft School of the Future Energy Conservation w/ LEED™

- Energy & Atmosphere Conservation
 - Reduce, Reuse, Eliminate

50 KW PHOTOVOLTAIC

TURN OFF THE LIGHTS!
INTEGRATION OF PHOTO
AND MOTION SENSORS
WITH HVAC AND LIGHTING

'RIGHT SIZING' HVAC 40% BETTER THAN ASHRAE



ORIENT FOR DAYLIGHTING





• • • Photovoltaic Payback Study

•100kw Photovoltaic Gross Price (incl. Tax): \$722,855 100%

•EDA Section 15 Grant: \$(289,149) -40%

Subtotal \$(433,706) 60%

•NJ Clean Energy Program Grant: \$(206,224) -60 of 60%

• *Price Less Incentives:* \$ 227,482 25%<u>+</u>

Revenues (25 year totals): Total Avoided electricity cost 495.808 Peak load savings 202,313 **HVAC** savings 36,310 Re-roofing Savings 72,620 Green attributes value 142.273 Electrical loss savings 14.874 **Total Revenue:** 964.197

THIS MEANS THAT THE RETURN ON INVESTMENT WILL BE \$38,568/yr AVERAGE OR A 5.8 YEAR PAYBACK!

Howell Schools HVAC Requirements

- New ANSI Acoustics Standard for Classrooms
- HVAC uses 45-75% of school's energy
- ASHRAE Standard 90.1-1999
 - Energy efficiency
- ASHRAE Standard 62.1-1999
 - Indoor Air Quality & Ventilation
 - 15 cfm OA per occupant at all loads
 - 30-60% relative humidity control
 - MIRV 6 or greater (at least 2") filtration
- ASHRAE Standard 55-1992
 - Thermal comfort

Problems with Conventional School HVAC Systems

- Many have poor temperature control
- Most have poor humidity control
 - Potential for mold
- Most are not energy-efficient
- Most use energy inefficient strategies
 - e.g. reheat, simultaneous heating & cooling, excessive use of refrigeration
- Most have poor Indoor Air Quality (IAQ)
 - insufficient outside air
 - insufficient filtration
- Most are noisy when operating
 - Interfere with learning

Why are most HVAC Systems lacking technically?

- The technical basis of most HVAC designs are 20 to 50 years old;
- Ventilation accounts for most energy use in school HVAC systems
 - Up to 90%
- Most systems were developed in age of cheap energy
- Systems were conceived to minimize ventilation
- There was little concern about IAQ & humidity control
- Conventional HVAC systems cannot efficiently meet IAQ standards
 - Ventilation considered an unavoidable penalty, hence IAQ vs. energy tradeoff

Howell HVAC Solution: Regenerative Dual Duct

- A high performance central HVAC system
 - Delivers 100% outside air through 2 ducts for optimal temperature control
- Employs multiple stages of energy recovery
- Employs evaporative cooling processes
- Eliminates most systematic energy waste found in conventional HVAC systems
- Consists of <u>off-the-shelf</u> components
 - Multiple vendors available

Energy Conservation w/ LEEDTM TABLE 2 - ELEMENTARY SCHOOL 1 SUMMARY OF DEGINERAL PROPERTY SCHOOL 1 SUMMARY S

TABLE 2 - ELEMENTARY SCHOOL 1 SUMMARY OF RESULTS										
Alternate	A1a (RDD)	A2a (VAV Water Chiller)	A2b (Co2 only)	A3a (VAV Air Chiller)	A3b (Co2 only)	A4c (GSHP)				
Lighting	199268	199268	199268	199268	199268	199268				
Other	59950	59950	59950	59950	59950	59950				
Subtotal	259218	259218	259218	259218	259218	259218				
Building Area	70000	70000	70000	70000	70000	70000				
BTU/SF/YR	12642	12642	12642	12642	12642	12642				
Electric Demand	188	220	264	299	356	282				
Electric Use	348512	390055	481737	423637	526297	799264				
Electricity Costs	\$ 47,252	\$52,879	\$ 64,122	\$ 61,841	\$ 75,104	\$ 97,224				
Natural Gas Use	11571	16225	27251	16225	27251	4314				
Natural Gas Cost	\$ 10,414	\$ 15,479	\$25,998	\$15,479	\$25,998	\$4,115				
Total Costs	\$ 57,666	\$ 68,358	\$90,120	\$ 77,320	\$101,102	\$101,339				
Total Energy Use BTU/SF/YR	33522	42197	62418	43834	64591	45133				
Net HVAC Loads BTU/SF/YR	20880	29554	49776	31191	51948	32490				
HVAC Load (% Total Load)	62%	70%	80%	71%	80%	72%				
HVAC Load (% Base Alt.)	100%	142%	238%	149%	249%	156%				
Annual Savings Vs. Base System	\$0									

Howell Elementary Schools



- o Material & Resource Conservation:
 - Minimum 20% post consumer OR 40% post industrial recycled content materials
 - Includes structural steel, aggregate, paving, outdoor play equipment, flooring, ceiling tiles, paint, carpet,
 - Local materials & manufacturers specified to reduce embodied energy.
 - Boilers, split-face block, roofing, millwork, furniture, windows, etc.
 - Local materials & manufacturers specified to reduce embodied energy.
 - 75% minimum construction waste recycling rate.

Practical Applications:

• • • Howell Elementary Schools

- Indoor Environmental Quality:
 - 100% Outside Air HVAC system (Typical AC delivers 25%)
 - Non-toxic finishes & materials (High levels of VOC's, formaldehyde, & chlorine eliminated)
 - 3 Stages of filtration to produce 'clean room' indoor air quality.
 - Individual room controls

Practical Applications: Howell Elementary School

- o Community:
 - School used throughout the year for Adult education classes, recreation, and town meetings.
- Fundamental Systems Commissioning:
 - Third Party Verification of HVAC design & Installation ensures désign team & Owner that system is installed & performing as intended. Similar to performance specifications, but requires independent third party verification. Recent NJ code adoption of ASHREA 90.1, 1999 requires systems commissioning.
 - Integration of lighting & HVAC with occupancy sensors & DDC controls optimizes system performance by assuring optimum interaction.

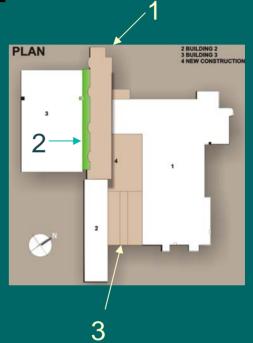
Howell Township Schools Lessons Learned

- H.P. Design concept should be brought in during initial planning stage;
 - Fast Track process did not allow for design alternate considerations
 - Owner and CM education factor in acceptance of ideas and principles.
 - No Sky lights or significant day lighting other than large windows in classrooms because of budget perceptions and orientation
 - Waterless Urinals not specified as alternate because of odor & maintenance concerns:
- Floor Plan & Site plan already fixed and not optimal;
 - Parity among schools often an issue
- o Trade-offs occur
 - No irrigation system installed in lieu of rainwater catchment
 - Innovative "right size" HVAC system currently eligible for less utility rebates based on equipment alone.
 - Innovative HVAC design requires longer burn in time and training.

Practical Applications:

Morris County Vocational Technical School





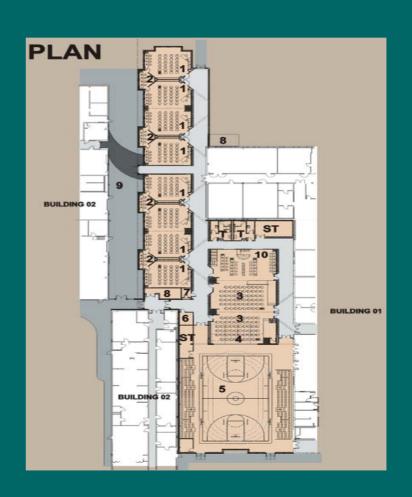
1. Route 53 Perspective

- Renovation of an existing 50,000 s.f. in 4 buildings and 32,000 square foot addition to house 16 classrooms, gym, media center, 2 large lecture halls, and support area
- Designed to meet LEED Silver
- Project Cost: Ren.- \$160/s.f.; Addition- \$140/s.f.

Practical Applications: Morris County Vocational Technical School

o Site:

- Infill/ Adaptive Reuse
- 0 increase in rate and quantity of storm water runoff.
- High reflectance roof coating to reduce heat islands
- Zero direct beam illumination from addition

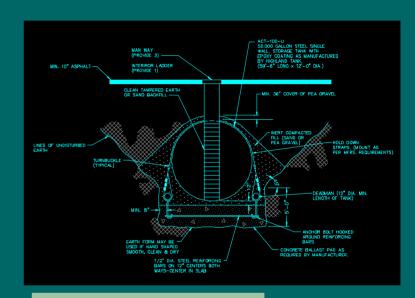


Practical Applications:

Morris County Vocational Technical School

Water

- Toilet usage accounts for 80%
- Proposed Waterless Urinals
- Proposed 1 gal flush toilets
- 50,000 gal. Rainwater Collection System reducing potable water use for sewage conveyance
- No Site irrigation system



Rainwater Tank Section

Practical Applications: Morris County Vocational Technical School



- Energy: HVAC accounts for 75% of use
- o On-Site Generation for 100% power with Microturbines & waste heat used to drive absorption chillers
- Systems Commissioning
- CFC & HCFC free chillers
- 60% better than ASHRAE
- DDC Controls throughout w/ photo sensors

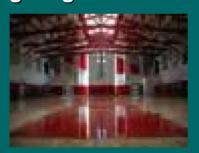
Morris County Vocational Technical School



oResponsible lighting as feature



oDay lit classroom Day lit Gym



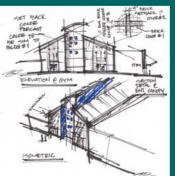


oSolar Tubes used to daylight interior 3,000 sf Fitness Center in Existing Building. NO LIGHTS ON!!!

Practical Applications: Morris County Vocational Technical School

- Materials and Resources:
 - Minimum recycled content in products
 - Significant Building Reuse
 - Construction WasteManagement to recycle75% minimum
 - Local materials
 - Certified Wood





3. Gym Perspective

Practical Applications: Morris County Vocational Technical School

- Indoor Environmental Quality:
 - 100 % Outside Air w/ Displaced Ventilation
 - Low VOC, formaldehyde free, and non-chlorine finishes specified
 - CO2 monitoring in Gym and large lecture halls
 - Construction IAQ management plan



Morris County School of Technolog Lessons Learned

- o Bidding Flaws can affect design
 - Forced to rebid due to technicality in bids and redesign eliminating rainwater system and microturbines as an option. HVAC system still 30% better than ASHRAE
 - Owner and CM education factor in acceptance of ideas and principles.
 - Waterless Urinals not specified as alternate because of odor & maintenance concerns
 - Convinced Prisco Office to install demonstration unit
- Site very tight and many interior spaces created.
- o Trade-offs occur
 - Innovative "right size" HVAC system currently eligible for less utility rebates based on equipment alone.
 - Innovative HVAC design requires longer burn in time and training.
 - Some green features sacrificed in order to afford building

Practical Applications: Microsoft School of the Future





- o 160,000sf new school in Fairmont Park, PA for 800 students
- Designed to meet LEED GOLD
- o Projected Cost: Ren.- \$230/s.f.; Awarded 05/2005
- o Completion scheduled for 09/2006

Microsoft School of the **Future Site Design with** Sustainable Site Design **LEED**TM

Protect, Restore, Respect

PROTECT EXIST. TREES. REUSE CUT TREES

ORIENT CLASSROOM WING FOR NORTH/ SOUTH EXPOSURE:

REFLECTIVE ROOF & GREEN ROOF TO REDUCE HEAT **ISLAND**

> **REUSE EXIST** PARKING.





MICROSOFT HIGH SCHOOL LEED Checklist and Implementation Strategy Plan

							A
Submit f		•	☑	▽	Strategy to Achieve/Outstanding Issues	 Status	Who's Working <mark>▼</mark> On It
	Sustainab	le Sites	Possible Points	14	oracogy to Aomo ve/outstanding issues	Otatus	OH K
	Prereq 1 Erosion & Sedimentation Control			0			
	Credit 1	Site Selection		1	parkland	Closed	
M	Credit 2	Urban Redevelopment			Verify Site Density Qualifies	CD's (Not Done)	Civil Engineer
	Credit 3	Brownfield Redevelopment					
Υ	Credit 4.1	Alternative Transportation, Public Transportation Access			Confirm proximity of public transit	Complete	Traffic Eng.
Y	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms			40 bike spaces and 5 showers req'd based on 800 occupants	CD's (Not Done)	Architect/Plum.
M	Credit 4.3	Alternative Transportation, Alternative Fuel Refueling	Stations	1	Confirm if District utilizes such vehicles	CD's (Not Done)	PSD/PSIT
Y	Credit 4.4	Alternative Transportation, Parking Capacity		1	Do not exceed minimum local zoning req.	CD's (Confirm)	Civil Engineer
N	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open S	pace	1	Limit Site Disturbance	Site Package out to Bid (not noted in bid documents)	Civil/Arch
М	Credit 5.2	Reduced Site Disturbance, Development Footprint			Reduce Building Footprint 25% below zoning	CD's (Confirm)	Arch./Civil
Υ	Credit 6.1	Stormwater Management, Rate and Quantity			Design No net increase in rate and quantity	CD's (Confirm)	Civil
M	Credit 6.2	Stormwater Management, Treatment			Remove 80% of TSS & 40% of TP (Rainw ater System & Green Roof)	CD's (Confirm)	Plum./Civil/Arch
M	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof			Specify High Albedo Finishes or shading. Shade trees show n on draw ings. Materials not show n on draw ings.	CD's (Confirm)	Civil/Arch
Υ	Credit 7.2	Landscape & Exterior Design to Reduce Heat Is	lands, Roof	1	Design/Specify Energy Star Roof	CD's (Confirm)	Architect
Υ	Credit 8	Light Pollution Reduction		1	Design Zero Light Spill Site Plan	CD's (Confirm)	⊟ectrical
6 to 11							

Microsoft School of the Future Site Design with LEEDTM

TRADE-OFFS

- Natural swales used to recharge aquifers in lieu of permeable pavement.
- Unable to limit site disturbance due to extensive need to regrade
- Tree planting for exterior non roof shading not in scope of contract

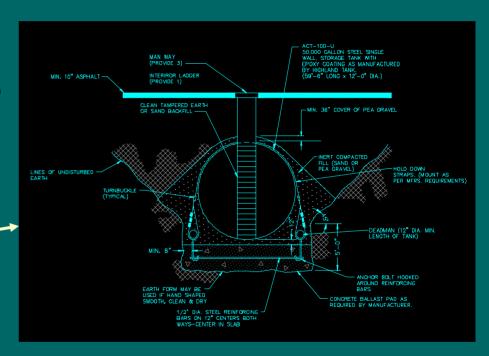
Microsoft School of the Future Water Conservation w/ LEEDTM

- Water Conservation
 - Reduce, Reuse, Eliminate

BELOW GROUND CATCHMENT TO FLUSH ALL TOILETS.

TOILETS ACCOUNT FOR 80% OF WATER USAGE!

PHILADELPHIA WATER DEPARTMENT PROVIDED \$70,000 GRANT FOR INNOVATION



Microsoft School of the Future Water Conservation w/ LEEDTM

5	Water Eff	ciency Possible Points	5			
Y	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1	No Irrigation System	CD's (Confirm)	Owner/Arch.
Y	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1	No Irrigation System	CD's (Confirm)	Owner/Arch.
Y	Credit 2	Innovative Wastewater Technologies	1	Rainw ater to convey sew age from toilets	CD's (Confirm)	Plumbing Eng.
Y	Credit 3.1	Water Use Reduction, 20% Reduction	1	Rainw ater Collection System to Flush Toilets	Programming	Plumbing Eng.
Y	Credit 3.2	Water Use Reduction, 30% Reduction	1	Rainw ater Collection System to Flush Toilets	Programming	Plumbing Eng.
5						

Microsoft School of the Future Water Conservation w/ LEEDTM

TRADE-OFFS

 Rainwater system selected in lieu of waterless fixtures. Cost is more! Concern of maintenance and vandalism factors in decision.



Microsoft School of the Future Energy Conservation w/ LEED™

- Energy & Atmosphere Conservation
 - Reduce, Reuse, Eliminate

10 KW BUILDING INTEGRATED PHOTOVOLTAIC CURTAIN WALL SUSTAINABLE DEVELOPMENT FUND CONTRIBUTED \$145,000

TURN OFF THE LIGHTS! INTEGRATION OF PHOTO AND MOTION SENSORS WITH HVAC AND LIGHTING

'RIGHT SIZING' HVAC

40% BETTER THAN ASHRAE



ORIENT FOR DAYLIGHTING



Microsoft School of the Future Energy Conservation w/ LEED™

7	Energy &	Atmosphere Possible Poir	its 17			
	Prereq 1	Fundamental Building Systems Commissioning	0	Ow ner to provide Commissioning	Required by Code	Owner
	Prereq 2	Minimum Energy Performance	0	Part of HVAC System Design	Required by Code	HVAC Engineer
	Prereq 3	CFC Reduction in HV AC&R Equipment	0	Part of HVAC System Design	Required by Code	HVAC Engineer
Υ	Credit 1.1	Optimize Energy Performance, 20% New/ 10% Existing	2	Evaporative Cooling/Heat Recovery	CD's**	HVAC Engineer
Υ	Credit 1.2	Optimize Energy Performance, 30% New/ 20% Existing	2	Thermal Storage	CD's**	HVAC Engineer
Υ	Credit 1.3	Optimize Energy Performance, 40% New/ 30% Existing	2	Heat Recovery/Motion Sensors	CD's**	HVAC Engineer
М	Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2		CD's**	HVAC Engineer
М	Credit 1.5	Optimize Energy Performance, 60% New/ 50% Existing	2		CD's**	HVAC Engineer
N	Credit 2.1	Renewable Energy,5%	1	Building Integrated Photovoltaics Not large enough system to meet credit requirements. Included as demo/educational	Closed	⊟ectrical
N	Credit 2.2	Renewable Energy, 10%	1	Cost Prohibitive	Closed	
N	Credit 2.3	Renewable Energy, 20%	1	Cost Prohibitive	Closed	
M	Credit 3	Additional Commissioning	1	At Owner's Discretion	CD's (Confirm)	PSIT
Υ	Credit 4	Ozone Depletion	1	Designs to exclude use of HCFC's	CD's (Confirm)	HVAC Engineer
	Credit 5	Measurement & Verification	1		07- (0-16-1)	
M				Include as part of DDC Controls Design	CD's (Confirm)	HVAC Engineer
М	Credit 6	Green Power	1	At Ow ner's Discretion	CD's (Confirm)	PSIT
7 to 14				**Aw aiting Building Energy Modeling	Proposals Needed	

Microsoft School of the Future Energy Conservation w/ LEED™

TRADE-OFFS

- Not enough funds to get large enough system for LEED credit for Renewable Energy
- Cost of additional commissioning (I.e. building envelop, etc) and additional controls for measurement and verification cost prohibitive.
- Green Power purchase sole decision of Owner. Operation Budget, not construction. This is an easy, no first construction cost credit.

Microsoft School of the Future **Material & Resource** Conservation Material & Resource

Conservation

• Recycle, Conserve, Reuse

40 TREES CUT TO BE USED FOR WOOD TRIM, PANELING, AND FURNITURE ON THE BLDG. WWW.CITILOGS.ORG

HIGH RECYCLED CONTENT & LOCAL MATERIALS SPECIFIED. WWW.BUILDINGGREEN.COM

FSC CERTIFIED GYM FLOORS WWW.FSC.ORG



Microsoft School of the Future Material & Resource Conservation

6	Materials	& Resources Possible Points	13			
	Prereq 1	Storage & Collection of Recyclables	0	Verify Recycling Policy	Verify w/owner	Owner
N	Credit 1.	Building Reuse, Maintain 75% of Existing Shell	1	N/A		
N	Credit 1.2	Building Reuse, Maintain 100% of Existing Shell	1	N/A		
N	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1	N/A		
Υ	Credit 2.1	Construction Waste Management, Divert 50%	1	Develop Specifications Requiring Recycling	Done	Architect
Υ	Credit 2.2	Construction Waste Management, Divert 75%	1	Develop Specifications Requiring Recycling	Done	Architect
М	Credit 3.1	Resource Reuse, Specify 5%	1	Timber harvesting for casew ork	Need to issue addendum for Site Package to include requirement to harvest trees.	Architect/Civil
М	Credit 3.2	Resource Reuse, Specify 10%	1	Timber harvesting for casew ork	Need to issue addendum for Site Package to include	Architect/Civil
Y	Credit 4.1	Recycled Content, Specify 25%	1	Develop Specifications for Recycled Content	Done	Architect
Y	Credit 4.2	Recycled Content, Specify 50%	1	Develop Specifications for Recycled Content	Done	
Y	Credit 4.2 Credit 5.1	Local/Regional Materials, 20%M anufactured Locally	1	Develop Specifications for Recycled Content Develop Specifications for Local Materials	Done	Architect Architect
M	Credit 5.1	Local/Regional Materials, 20% Above, 50% Harvested Locally	1	Develop Specifications for Local Materials	Bid Dependent	Architect
M	Credit 6	Rapidly Renewable Materials	1	Specify Alternate Materials (Linoleum/Bamboo)		Architect/Owner
Y	Credit 7	Certified Wood	1	Develop Specifications for Certified Wood	Done	Architect
6 to 10						

Microsoft School of the Future Material & Resource Conservation

TRADE-OFFS

- New Building instead of renovation, addition, or rehab of existing inner city property. No LEED credit for building reuse.
- Total amount of recycled content, local materials, and renewable materials is subject to products provided by lowest bid public contractor. Can not finalize credit until after shop drawing approval.



- Indoor Air Quality
 - People spend 90% of time in buildings. Performance of students & staff can be increased by 25%.
 - Eliminate formaldehyde, VOC's, and Chlorine found in many typical building products which off gas toxins and are dangerous in fires.
 - Provide adequate HVAC with 100% outside air & proper filtration
 - Control lighting and HVAC through direct & indirect means (sensors, sun shades, orientation)
 - Providing sufficient opportunity for users to regulate the temperature with localized controls integrated with sensors.

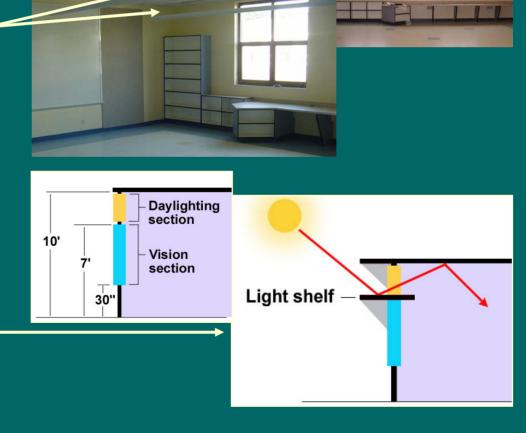
 Acoustic Comfort, Remove Toxins, Effective Ventilation, Adequate Daylighting

PHOTO/MOTION SENSORS TURN OFF LIGHTS & HAVC.

80% OUTSIDE AIR VENTILATION AND NON TOXIC FINISHED.

INDIVIDUAL ROOM CONTROLS FOR OPTIMAL USER COMFORT

LIGHT SHELF AT 2/3 POINT OF WINDOW INCREASES DAYLIGHT EFFECTIVENESS 50%

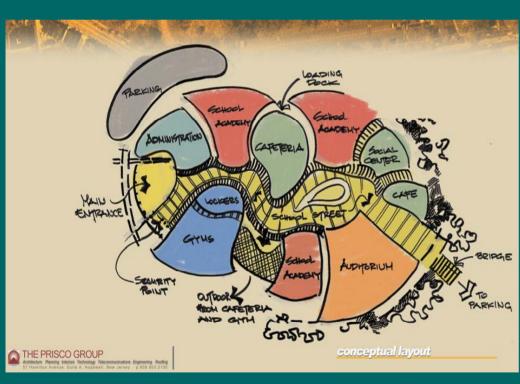


10	Indoor En	vironmental Quality Possible Points	15			
	Prereq 1	Manimum IAQ Performance	0	Required by Code		HVAC Engineer
	Prereq 2	Environmental Tobacco Smoke (ETS) Control	0	School Policy		Owner
М	Credit 1	Carbon Dioxide $({\rm CO}_2)$ Monitoring	1	Must be for entire building in return air vents	CD's (Confirm)	HVAC Engineer
м	Credit 2	Increase Ventilation Effectiveness	1	Air changes greater than .9 per ASHRAE	CD's (Confirm)	HVAC Engineer
Y	Credit 3.1	Construction IAQ Management Plan, During Construction	1	Develop Specifications for IAQ Plan	CD's (Confirm)	Arch/Owner
Y	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1	Develop Specifications for IAQ Plan	CD's (Confirm)	Arch/Owner
М	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1	Develop Specifications for Low Emitting Mat'ls	CD's (Confirm)	Arch/Owner
Υ	Credit 4.2	Low-Emitting Materials, Paints	1	Develop Specifications for Low Emitting Mat'ls	Done	Arch/Owner
Y	Credit 4.3	Low-Emitting Materials, Carpet	1	Develop Specifications for Low Emitting Mat'ls	Done	Arch/Owner
Υ	Credit 4.4	Low-Emitting Materials, Composite Wood	1	Develop Specifications for Low Emitting Mat'ls	Done	Arch/Owner
Υ	Credit 5	Indoor Chemical & Pollutant Source Control	1	Design HVAC system and designate locations	CD's (Confirm)	HVAC/Arch/Own
Υ	Credit 6.1	Controllability of Systems, Perimeter	1	Operable Windows	CD's (Confirm)	Arch/Owner
Υ	Credit 6.2	Controllability of Systems, Non-Perimeter	1	Include Controls ineach classroom	CD's (Confirm)	HVAC Engineer
Υ	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1	Part of HVAC System Design	CD's (Confirm)	HVAC Engineer
М	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1	Add onfeature to DDC Controls	CD's (Confirm)	HVAC Engineer
М	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1	Size Windows & Design Correctly	CD's (Confirm)	Architect
Υ	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1	Provide Windows in all Occupied Spaces	CD's (Confirm)	Architect
10 to 15						

TRADE-OFFS

- CO2 monitoring used only in large spaces, not returns of entire system as required for LEED credit.
- Hard to regulate adhesives and sealants in construction. Perceived to compromise performance.
- Daylighting Study determined that solar tubes and skylights were noT necessary in classrooms if gym had skylights. Meeting LEED credit is not necessarily good daylighting.

Application of High Performance Design with LEED™

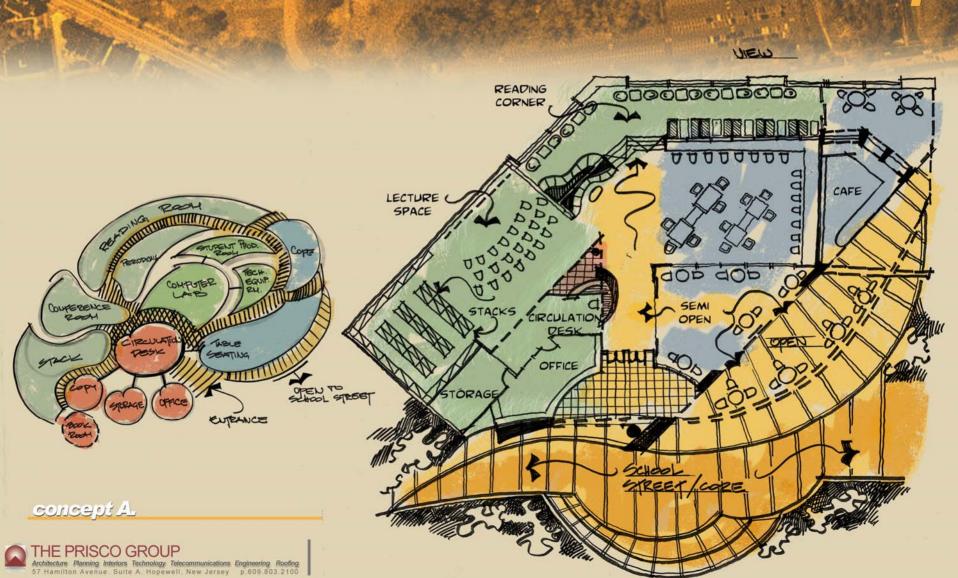


- Education/Community Involvement
 - TEACHING TOOL:

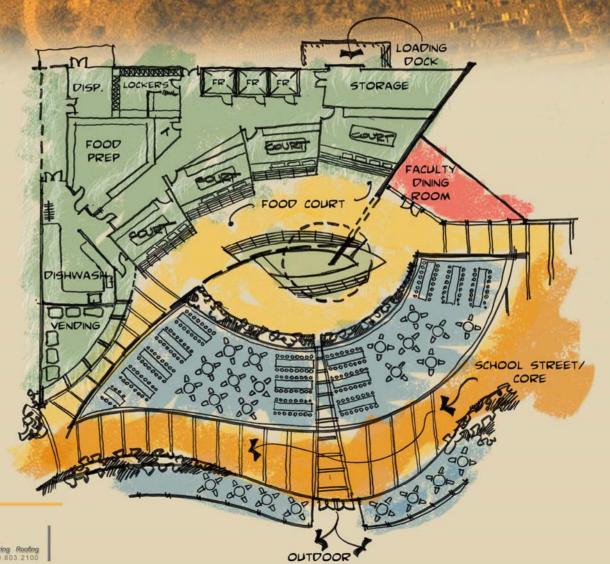
 Rainwater system, PV,
 daylighting, non toxic
 materials
 - COMMUNITY RESOURCE:

 Auditorium, Media Center,
 Classrooms, Gym, Fitness
 Center, Adult Education
 - Conserve tax dollars on O&M while providing healthier, more productive environment for all to enjoy.

social center concept

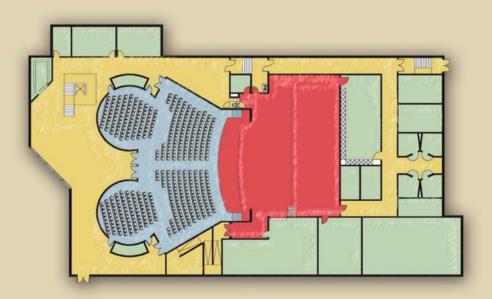


food court concept

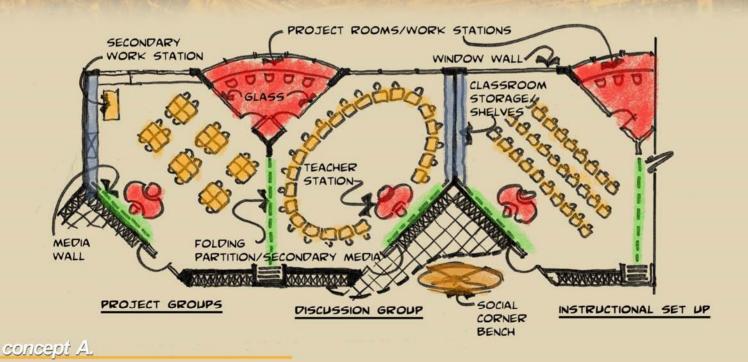


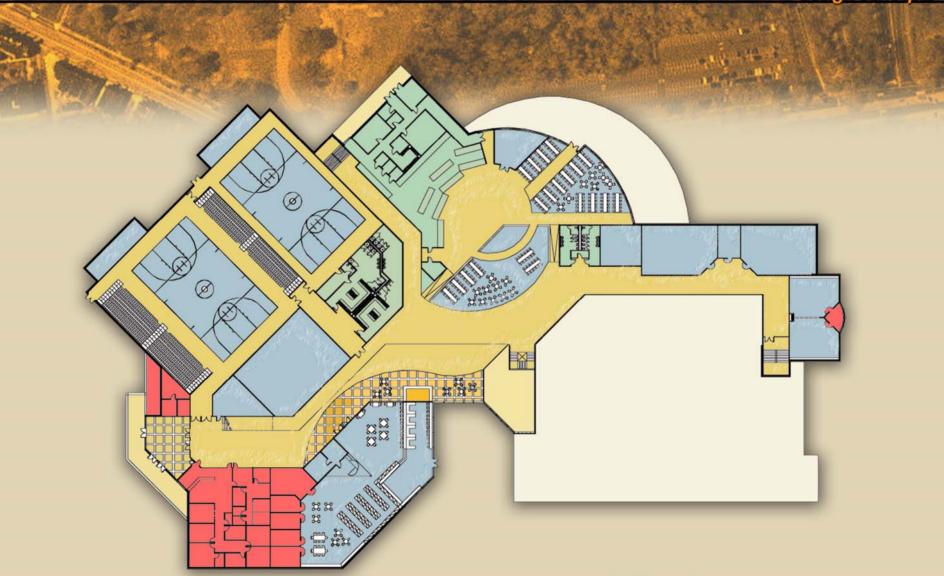
concept B.

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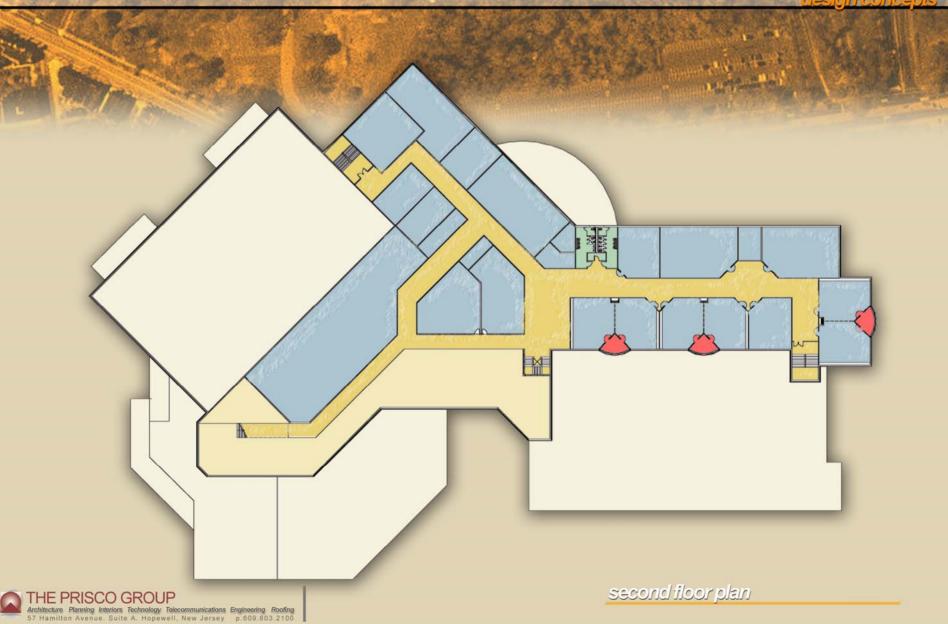
classroom concepts

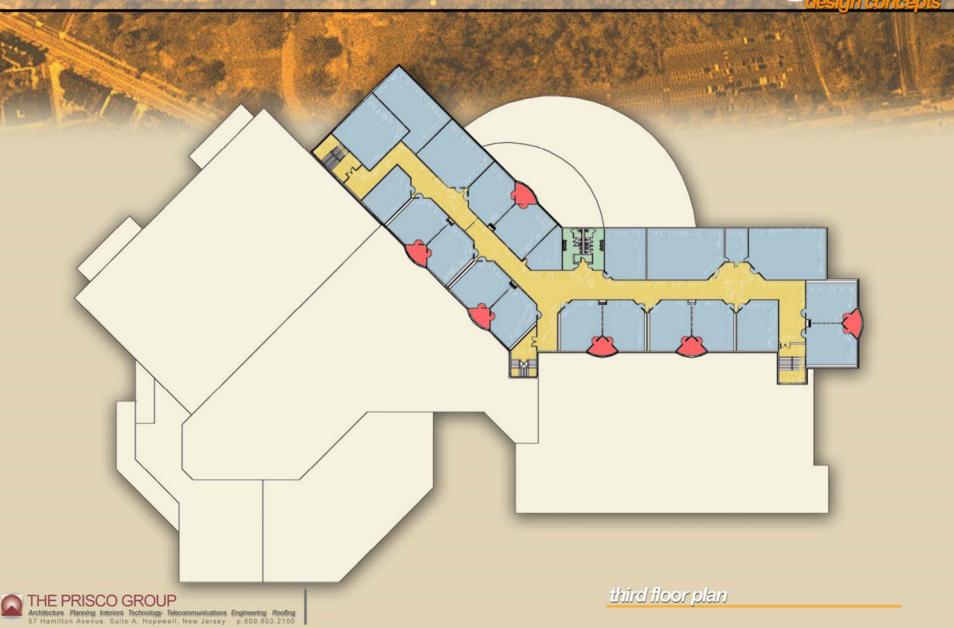






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MICROSOFT HIGHSCHOOL Preliminary LEEDTM Scorecard

COUNCIL OF	LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN Version 2.1 Checklist	
		Microsoft High School
Yes ? No		Philadeplhia, PA
7 6 1	Sustainable Sites	14 Points
Yes ? No		
4 1	Water Efficiency	5 Points
	-	
Yes ? No		
8 4 1	Energy & Atmosphere	17 Points
Yes ? No		
7 8 2	Materials & Resources	13 Points
Yes ? No		
11 4	Indoor Environmental Quality	15 Points
Yes ? No		
3	Innovation & Design Process	5 Points
00.0	l'' 001 D	

39 Credit = GOLD

Is High Performance Design for your schools?

- Higher Test Scores
 - Studies show students with the most natural day lighting progressed 20% faster in math and 26% faster in reading.
- Increased Average Daily Attendance
 - Superior indoor air quality results in fewer sick days for students and teachers, especially those suffering from Asthma.
- Reduced Operating Costs
 - Durable green materials, and energy and water conserving features translate to 40 to 90% lower operating costs yearly.

Is High Performance Design for your schools?

- o Increased Employee Satisfaction & Retention:
 - Visual and thermal comfort, good acoustics, and high indoor air quality are positive factors in recruiting and retaining effective teachers.
- o Reduced Liability Exposure:
 - Healthy buildings reduce a school districts exposure to health related law suits.

Is High Performance Design for your schools?

- Reduced Environmental Impact
- Significant Utility Rebates Available for many LEED™ technologies
- Streamlined permitting process
- O NO ADDITIONAL FIRST COST!!!!

Cost of High Performance Design with LEED

o LEED Registration \$0* (\$350.00)

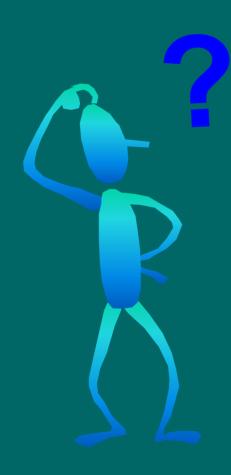
o Systems Commissioning \$0* (est. 1-2% HVAC Con. Cost)

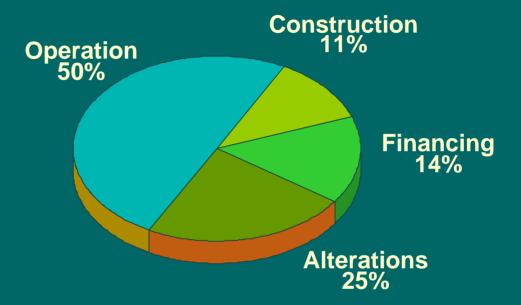
• LEED Design/Documenting \$0** (not established 1-2% fee increase)

o LEED Certification \$0* (\$1,200)

* 50% Cost Share through the Smart Start Program in combination with utility rebates for lighting, HVAC, & sensors through Smart Start can completely offset the cost of LEED registration, documentation, & commissioning as in the Howell Schools Project.

Questions?





www.usgbc.org
www.usgbcnj.org
www.thepriscogroup.com